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3,309 miles to be carried out, unless the route is slightly changed to shorten the distance.

The Pan-American line presents no engineering difficulties greater than those which have been met and surmounted in lines constructed, such as the railway from Callao to Oroya, with its infinity of grades, curves, bridges, viaducts, tunnels, and switch-backs, or in the Guayaquil and Quito Railroad, as well as on several Mexican roads. The questions of a practical nature are the cost of overcoming these obstacles and the ability of the various Governments to supply the deficiency where the prospective traffic does not afford sufficient inducement to private enterprise. These questions are answered in the purpose of the Chilean Government to bore a tunnel through the Andes, in the action of the Argentine Republic in building a northern extension through the Quebrada of Humahuaca into Bolivia, in the policy of the Bolivian Government for the line connecting Tupiza and Uyuni, and in the plans of the Peruvian Government for closing the gap to Cuzco.

THE ESSENTIAL IN GEOGRAPHY.

Professor Wm. M. Davis, of Harvard University, was chairman of the Section of Geology and Geography at the meeting of the American Association for the Advancement of Science in St. Louis last winter. He addressed the Section on "Geography in the United States," and in the course of his remarks gave a definition of geography and outlined what he believed to be the essential features of the study. The following are extracts from this portion of Professor Davis's paper:

The essential in geography is a relation between the elements of terrestrial environment and the items of organic response; this being only a modernized extension of Ritter's view. Everything that involves such a relationship is to that extent geographic. Anything in which such a relationship is wanting is to that extent not geographic. The location of a manufacturing village at a point where a stream affords water-power is an example of the kind of relation that is meant, and if this example is accepted, then the reasonable principle of continuity will guide us to include under geography every other example in which the way that organic forms have of doing things is conditioned by their inorganic environment.

The organic part of geography must not be limited to man, because the time is now past when man was studied altogether apart from the other forms of life on the earth. The colonies of ants on our western deserts, with their burrows, their hills, their roads and their threshing floors, exhibit responses to elements of environment found in soil and climate as clearly as a manufacturing village exhibits a response to

water-power. The different coloration of the dorsal and ventral parts of fish is a response to the external illumination of our non-luminous earth. The word *arrive* is a persistent memorial of the importance long ago attached to a successful crossing of the shore-line that separates sea and land. It is not significant whether the relation and the elements that enter into it are of easy or difficult understanding, nor whether they are what we call important or unimportant, familiar or unfamiliar. The essential quality of geography is that it involves relations of things organic and inorganic; and the entire content of geography would include all such relations.

A large library would be required to hold a full statement of so broad a subject, but elementary text-books of geography may be made by selecting from the whole content such relations as are elementary, and serviceable handbooks may be made by selecting such relations as seem important from their frequency or their significance. The essential throughout would, however, still be a relation of earth and life, practically as Ritter phrased it when he took the important step of introducing the causal notion as a geographical principle.

Thus defined, geography has two chief divisions. Everything about the earth or any inorganic part of it, considered as an element of environment by which the organic inhabitants are conditioned, belongs under physical geography or physiogeography.* Every item in which the organic inhabitants of the earth—plant, animal, or man—show a response to the elements of environment, belongs under organic geography. Geography proper involves a consideration of relations in which the things that belong under its two divisions are involved.

The validity of these propositions may be illustrated by a concrete case. The location and growth of Memphis, Helena and Vicksburg are manifestly dependent on the places where the Mississippi River swings against the bluffs of the uplands on the east and west of its flood-plain. The mere existence and location of the cities, stated independent of their controlling environment, are empirical items of the organic part of geography, and these items fail to become truly geographic as long as they are stated without reference to their cause. The mere course of the Mississippi, independent of the organic consequences which it controls, is an empirical element of the inorganic part of geography, but it fails to become truly geographic as long as it is treated alone. The two kinds of facts must be combined in order to gain the real geographic flavor.

Geography is therefore not simply a description of places; it is not simply an account of the earth *and* of its inhabitants, each described independent of the other; it involves a relation of some element of physical geography to some item of organic geography, and nothing from which this relation is absent possesses the essential quality of geographical discipline. The location of a cape or of a city is an elementary fact which may be built up with other facts into a relation of full geographic meaning; but taken alone it has about the same rank in geography that spelling has in language. A map has about the same place in geography that a dictionary has in literature. The mean annual temperature of a given station, and the occurrence of a certain plant in a certain locality, are facts of kinds that must enter extensively into the relationships with which geography deals; but these facts, standing alone, are wanting in the essential quality of mature geographical science. Not only so; many facts of these kinds may, when treated in other relations, enter into other sciences; for it is not so much the thing that is studied as the relation in which it is studied that determines the science to which it belongs.

* It should be noted that the British definition of physiography gives it a much wider meaning than is here indicated.

I therefore emphasize again the broad general principle that mature scientific geography is essentially concerned with the relations among its inorganic and organic elements; among the elements of physical and organic geography.

There can be no just complaint of narrowness in a science that has charge of all the relations among the elements of terrestrial environment and the items of organic response. Indeed, the criticism usually made upon the subject thus defined is, as has already been pointed out, that it is too broad, too vaguely limited, and too much concerned with all sorts of things to have sufficient unity and coherence for a real science. Some persons, indeed, object that geography has no right to existence as a separate science; that it is chiefly a compound of parts of other sciences; but if it be defined as concerned with the relationships that have been thus specified, these objections have little force. It is true, indeed, that the things with which geography must deal are dealt with in other sciences as well, but this is also the case with astronomy, physics, chemistry, geology, botany, zoology, history, economics.

There is no subject of study whose facts are independent of all other subjects; not only are the same things studied under different sciences, but every science employs some of the methods and results of other sciences. The individuality of a science depends not on its having to do with things that are cared for by no other science, or on its employing methods that are used in no other science, but on its studying these things and employing these methods in order to gain its own well-defined object. Chemistry, for example, is concerned with the study of material substances in relation to their constitution, but it constantly and most properly employs physical and mathematical methods in reaching its ends. Botanists and zoologists are much interested in the chemical composition and physical action of plants and animals, because the facts of composition and action enter so largely into the understanding of plants and animals considered as living beings. Overappings of the kind thus indicated are common enough, and geography as well as other sciences exhibits them in abundance. It may be that geography has a greater amount of overlapping than any other science; but no valid objection to its content can be made on that ground; the maximum of overlapping must occur in one science or another—there can be no discredit to the science on that account. Geography has to do with rocks whose origin is studied in geology; with the currents of the atmosphere, whose processes exemplify general laws that are studied in physics; with plants and animals, whose forms and manners of growth are the first care of the botanist and the zoologist; and with man, whose actions recorded in order of time occupy the historian; but the particular point of view from which the geographer studies all these things makes them as much his own property as they are the property of any one else.

In view of what has been said, let me return to the close scrutiny that I have urged as to what should be admitted within the walls of a geographical society. We will suppose the geography of Pennsylvania is under discussion; as a result there must be some mention of the occurrence of coal, because coal, now an element of inorganic environment, exerts a control over the distribution and the industries of the population of Pennsylvania. But the coal of Pennsylvania might be treated with equal appropriateness by a geologist, if its origin, its deformation and its erosion were considered as local elements in the history of the earth; by a chemist, if its composition were the first object of attention; by a botanist, if the ancient plants that produced the now inorganic coal-beds were studied. Furthermore, it would be eminently proper for the geologist to make some mention of the present uses to which coal is put; or for the chemist and the botanist to tell something of

the geological date when coal was formed, if by so doing the attention of the hearer could be better gained and held, and if the problem at issue could thereby be made clearer and more serviceable. So the geographer is warranted in touching upon the composition, the origin, the exploitation of the Pennsylvania coal-beds, if by so doing he makes a more forcible presentation of his own problem ; but if he weakens the presentation of his own problem by the introduction of these unessential facts, still more if he presents these unessential facts as his prime interest, he goes too far. The point of all this is that students in many different sciences may have to consider in common certain aspects of the problems presented by the coal of Pennsylvania ; but that each student should consider Pennsylvania coal in the way that best serves his own subject. The scrutiny that I have urged would, therefore, be directed chiefly to excluding from consideration under geography the non-geographic relations of many things that various sciences have to study in common, and to bringing forward in geography all the problems that are involved in relations of the the earth and its inhabitants.

UNITED STATES GEOLOGICAL SURVEY:
BULLETIN NO. 225.

*Contributions to Economic Geology, 1903, by S. F. Emmons and
C. W. Hays, Geologists-in-Charge.*

This *Bulletin* represents the policy of publishing early each year a condensed review of the results of the Survey's investigations of the previous year. The papers exclude all purely scientific matters, and are thus fitted to give, at the earliest date, the information which the busy practical man needs concerning the development of our mineral resources. In some cases the brief treatment is all that is required, and in others it is preliminary to more full and formal publications which are to be made later.

Among the papers in this volume is an account by A. H. Brooks of Placer Mining in Alaska in 1903. While lode-mining is developing in the Territory, six-sevenths of Alaska's mineral product for the year was from placers. There is great need of improved communications. It costs \$5 per ton to land freight from steamers at Nome. A deep-water pier is much needed, but would be difficult to construct because of the great ice-floes, which are sometimes piled to a height of 100 feet on that shore. Lode-mining is practiced in southeastern Alaska, but the Seward Peninsula is still the centre of the more important mining operations, and \$20,000,000 in value have been taken from that region since 1899, and 100 miles of ditches are in operation on the Peninsula. Beach-mining